

Appln. No. 09/697,389
Amdt. Dated February 9, 2004
Reply of Office Action of November 7, 2003

Amendments to the Claims:

Please amend claims 1-7 as follows. The following listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

Claim 1 (Currently Amended). An image processing method for noise filtering an image sequence representing a threadlike structure on a background, including an acquisition of point data in first and second sequence images and an estimation of the corresponding filtered point data for constructing a filtered second image, the point data being the intensities associated to co-ordinates of image points, said method comprising, performed in each sequence image, the steps of:

extracting the threadlike structure points,
forming strings from said extracted points,
temporally filtering the data of the points located outside the strings denoted background points,
spatially filtering the data of the string points, and

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constructing the filtered second image data by performing an insertion of the spatially filtered data of the string points into the temporally filtered data of the background points.

Claim 2 (Currently Amended). A method as claimed in Claim 1, further comprising the steps of:

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COL 1
based on the string formation performed in said sequence images, providing a binary control signal [St(i,j)] formed of a list of the string points with their running number on the strings and their co-ordinates in the processed image, which determines whether the current point is a string point or a non-string point regarded as a background point.

Claim 3 (Currently Amended). A method as claimed in Claim 2, ~~comprising~~ for constructing the filtered second image, comprising the steps of:

supplying said binary control signal (St(i,j)) for controlling the insertion of the spatially filtered data of the string points into the temporally filtered data of the background points.

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Claim 4 (Currently Amended). A method as claimed in Claim 3, ~~comprising~~, for eliminating phantom artifacts due to temporal filtering of the background data, comprising the steps of:

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COL 4
delivering the binary control signal $[St(i,j)]$ for
controlling the insertion operation through a logic OR operation,
whose inputs are ~~the~~ first and the second binary control ~~binary~~
signals related to the first and the second sequence images, said
OR operation triggering the spatially filtered data when at least
one of the ~~two~~ first and second binary control signals
corresponds to a string point.

Claim 5 (Currently Amended). A method as claimed in Claim 4, including a spatial filtering operation performed on string point data, comprising the steps of:

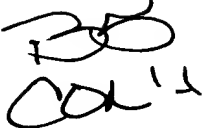
selecting string points $[A(i,j)]$ using the list of the
control signal $[St(i,j)]$,

propagating on one string from its start point to its end
point, according to the running number on the string,

while propagating, performing a spatial filtering on each
point of the string in a causal then in an anti-causal direction
as using a temporal filtering technique, and

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constructing a filtered second image data by performing an insertion of the spatially filtered data of the string points into the temporally filtered data of the background points, controlled by the binary control signal.

 Claim 6 (Currently Amended). A method as claimed in Claim 5, ~~comprising~~ for enhancing the string point data, comprising the steps of:

selecting ~~of~~ a string point $[A(i,j)]$ using the list of the control signal $[St(i,j)]$, said string point having a spatially filtered intensity $[U(i,j)]$, forming a neighborhood (V) for said string point using background points having temporally filtered intensities and estimating a mean temporally filtered intensity in said neighborhood $[\bar{U}(V)]$;

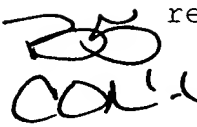
estimating the local contrast $[LC(i,j)]$ related to said string point as a difference between said mean intensity in said neighborhood and the intensity of said string point and multiplying said contrast by a factor (C) for providing an enhanced contrast $[C.LC(i,j)]$; and

calculating the enhanced string point intensity $[Ft(i,j)]$ as the difference between the enhanced contrast and the mean intensity $[\bar{U}(V)]$ in the neighborhood (V) of said point.

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Claim 7 (Currently Amended). A method as claimed in claim 5, including an enhancement operation performed on spatially filtered string point data, comprising the steps of:

selecting string points $[A(i,j)]$ using the list of the control signal $[St(i,j)]$, enhancing the string point data with respect to their local environment, and

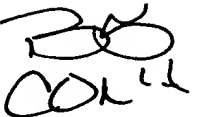
 constructing a filtered second image data by performing an insertion of the enhanced spatially filtered data of the string points into the temporally filtered data of the background points, controlled by the binary control signal.

Claim 8 (Original). A method as claimed in claim 1, wherein the images are medical examination digital images and the threadlike structure is a catheter guide-wire.

Claim 9 (Original). A system comprising a suitably programmed computer of a workstation or a special purpose processor having circuit means, which are arranged to process image data according to the method as claimed in claim 1, and having means to display images processed according to said method, and possible means to store the image data.

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Claim 10 (Original). An X-ray apparatus having means for acquiring medical digital image data and having a system as claimed in claim 9, having access to said medical digital image data for processing said image data.

 Claim 11 (Original). A computer program product comprising a set of instructions for carrying out a method as claimed in claim 1.

Claim 12 (Original). A method as claimed in claim 6, including an enhancement operation performed on spatially filtered string point data, comprising the steps of:

selecting string points $[A(i, j)]$ using the list of the control signal $[St(i, j)]$,

enhancing the string point data with respect to their local environment, and

constructing a filtered second image data by performing an insertion of the enhanced spatially filtered data of the string points into the temporally filtered data of the background points, controlled by the binary control signal.
